NORTHEAST FLOOD STUDIES

REPORT

ON

REVIEW OF SURVEY

FOR

FLOOD CONTROL & ALLIED PURPOSES

SACO RIVER BASIN

MAINE AND NEW HAMPSHIRE

DEPARTMENT OF THE ARMY
NEW ENGLAND DIVISION, CORPS OF ENGINEERS
WALTHAM, MASS.

15 SEPTEMBER 1967

DEPARTMENT OF THE ARMY
NEW ENGLAND DIVISION, CORPS OF ENGINEERS
424 TRAPELO ROAD
WALTHAM, MASSACHUSETTS 02154

IN REPLY REFER TO:

NEDED-R

21 September 1967

NOTICE OF REPORT

ON

FLOOD CONTROL AND ALLIED PURPOSES

SACO RIVER BASIN

MAINE AND NEW HAMPSHIRE

Notice is hereby given that a report on flood control and allied purposes in the Saco River basin, Maine and New Hampshire, authorized by resolutions of the Committee on Public Works of the United States Senate, adopted 30 July 1955 and 21 November 1955, and concerning which a public hearing was held at North Conway, New Hampshire, on 14 June 1962, has been made by the Division Engineer. The report, titled "Report on Review of Survey for Flood Control and Allied Purposes, Saco River Basin, Maine and New Hampshire" is unfavorable to water resource development by the Federal government at this time.

Additional improvements studied at the request of local interests were found not to warrant Federal participation at this time.

In accordance with law, the report is being referred for review to the Board of Engineers for Rivers and Harbors in Washington, D. C.

Interested parties may present written views on the report to the Board. Statements submitted should not repeat material previously presented at public hearings held by the Division Engineer, or contained in his report, as this information is already available to the Board. Information submitted should be new, specific in nature, and bear directly on the findings in the report.

Hearings will be held only on written request explaining the need to present material not included in the report.

Written communications should be mailed to the Board of Engineers for Rivers & Harbors, Washington, D. C. 20315, in time to reach the Board by 23 October 1967. If extension of this date is considered necessary, written request stating reasons and additional time desired should be mailed to the Board soon after receipt of this notice.

The Board will not take final action on the report until after expiration of this notice, or any extension thereof that may be granted, and after full consideration of all information submitted in response thereto. Should the Board contemplate action materially different from the recommendations of the Division Engineer, appropriate notice to that effect will be furnished to local interests directly concerned inviting their views and comments prior to final action.

Further information may be obtained from this office. Interested parties, including the press, may make such notes of the contents of the

report as they desire. Copies of the report will not be loaned for use outside of the office, but interested parties may purchase copies of the report, at $1.00 per copy, the cost of reproduction. Check or money order should be made payable to the Treasurer of the United States, and should be sent, together with request, to the Division Engineer, U. S. Army Engineer Division, New England, Corps of Engineers, 424 Trapelo Road, Waltham, Massachusetts 02154.

You are requested to give the foregoing information to any persons known by you to be interested in the report, and who, not being known by the Division Engineer, do not receive a copy of this public notice.

REMI O. RENIER
Colonel, Corps of Engineers
Acting Division Engineer

DEPARTMENT OF THE ARMY
NEW ENGLAND DIVISION, CORPS OF ENGINEERS
424 TRAPELO ROAD
WALTHAM, MASSACHUSETTS 02154

W. F. Mackie, Chief
Tech Liaison Office
894-2400 Ext 237

IN REPLY REFER TO:

ARMY ENGINEERS END STUDY OF SACO RIVER BASIN IN NEW HAMPSHIRE & MAINE; RECOMMEND THAT CONSTRUCTION OF FLOOD CONTROL STRUCTURES NOT WARRANTED

FOR RELEASE FRIDAY, SEPTEMBER 22, 1967, 12:01 A.M., EDT

WALTHAM, MASSACHUSETTS -- Economic justification - the federal yardstick by which water resources projects are measured, has ruled out, at this time, construction of flood control structures in the Saco River Basin in New Hampshire and Maine. Results of extensive engineering investigations by the New England Division, Corps of Engineers, in the 124-mile Saco River within the 1697 square-mile basin, were announced today to Congressional, State and local interests by Colonel Remi O. Renier, head of the Army Engineers in New England.

The report winds up a most detailed engineering study of the Saco River basin. The work cost $140,000. It recommends that local interests regulate future development in flood hazard areas and adopt suitable building codes providing for flood-proofing of existing structures in the flood plains.

In accordance with Congressional directives following the 1955 floods, the Engineers compiled data on location and costs of damages caused by five floods in the past 45 years along the Saco River and its tributaries. The study area extended from the headwaters of the River at Saco Lake in Crawford Notch, White Mountains, New Hampshire, to Saco and Biddeford tidal waters. A recurrence of the March 1936 flood of record would cause damages of $2.7 million in the Basin based on current values.

more

Engineers examined 26 locations in the Saco Basin for possible "flood control only" dams and reservoirs; six were rejected after initial consideration. The remaining 20 were studied further for the single purpose of flood control. Engineers selected six of the 20 sites and nine others and examined them extensively for possible multiple-purpose development, including flood control, hydroelectric power, recreation, fish and wildlife enhancement, water supply and low flow improvement, according to Colonel Renier.

Local protection projects for Biddeford and Saco, in Maine, and other locales in both states also were found to be NOT justified.

Data, opinions and recommendations were contributed by the Federal Power Commission, New Hampshire Department of Resources and Economic Development, Division of Parks, Fish and Wildlife Service, Bureau of Sport Fisheries and Wildlife, New Hampshire Fish and Game Department, and the Maine Department of Inland Fisheries and Game. Recommendations and comments by those agencies were carefully considered during the study and in preparing the final report, the Colonel said.

The report has been forwarded to the Chief of Engineers and the Board of Engineers for Rivers and Harbors.

REPORT

ON

REVIEW OF SURVEY

FOR

FLOOD CONTROL AND ALLIED PURPOSES

SACO RIVER BASIN
MAINE AND NEW HAMPSHIRE

DEPARTMENT OF THE ARMY
NEW ENGLAND DIVISION, CORPS OF ENGINEERS
WALTHAM, MASS.
15 September 1967

SYLLABUS

The Division Engineer finds that a flood problem exists in the Saco River Basin and there is a continuing need for electric power, water-oriented recreation, and water supply. The two largest floods of record in the basin, occurring in 1936 and 1953, caused damages of $1.6 and $1.8 million, respectively. It is estimated that a recurrence of the 1936 flood would today cause damages of $2.7 million. Extensive investigations and studies were made within the entire watershed area in search of suitable methods for mitigating flood damages in connection with allied water resource development. No structural methods for lessening flood damages were found warranted.

The Division Engineer recommends no structural improvements for flood control and allied purposes at this time. He recommends, for lessening future flood losses, that local interests (1) regulate future development in flood hazard areas in the Saco River basin, and (2) adopt suitable building codes providing for the flood-proofing of existing structures on the flood plains.

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DEPARTMENT OF THE ARMY
NEW ENGLAND DIVISION, CORPS OF ENGINEERS
424 TRAPELO ROAD
WALTHAM, MASSACHUSETTS 02154

IN REPLY REFER TO:

NEDED-R

15 September 1967

SUBJECT: Report on Review of Survey for Flood Control and Allied Purposes, Saco River Basin, Maine and New Hampshire

TO: Chief of Engineers
Attn: ENGCW-PD

1. AUTHORIZING RESOLUTIONS

This report is submitted pursuant to the authority contained in two resolutions of the Committee on Public Works of the United States Senate which read, in part, as follows:

> "That the Board of Engineers for Rivers and Harbors, created under Section 3 of the River and Harbor Act, approved June 13, 1902, be, and is hereby requested to review the reports of the Chief of Engineers on Saco River, Maine and New Hampshire, published as House Document Numbered 659, Seventy-first Congress, Third Session, and other reports, with a view to determining whether any modification of the recommendations contained therein is advisable at the present time, with particular reference to flood control at Lake Ossipee, New Hampshire." Adopted 30 July 1955.

> "That the Board of Engineers for Rivers and Harbors, created under Section 3 of the River and Harbor Act, approved June 13, 1902, be, and is hereby, requested to review previous reports on the . . . . . Saco River, Maine . . . . . with a view to determining the desirability of modifying the recommendations contained in such previous reports and the advisability of adopting further improvements for flood control and allied purposes, in view of the heavy damages and loss of life caused by recent hurricane floods in the New England area." Adopted 21 November 1955.

2. PURPOSE AND EXTENT OF THIS REPORT

This report, in full response to the authorizing resolutions, presents the results of studies to determine the desirability of improvements in the Saco River basin in the interest of flood control and allied purposes. It comprises a review of the flood problems in all areas of the watershed from the headwaters to the river mouth at the Atlantic Ocean, below Saco and Biddeford, Maine. The area covered by this report is shown on Plate No. 1.

A public hearing was held at North Conway, New Hampshire in June 1962 to determine the desires and views of interested parties. A synopsis of the hearing is given in paragraph 5c.

Field reconnaissance of problem areas and sites of potential improvements was made by the Division Engineer and representatives of his office. Flood damage data was collected by a field survey. Office studies utilized Corps of Engineer maps prepared for prior flood control studies, maps of the U. S. Army Map Service and the U. S. Geological Survey, and local maps.

3. PRIOR REPORTS

Flood control in the Saco River basin has been considered in the following published reports:

a. "308" Report. A report dated July 3, 1929 and printed as House Document No. 659, 71st Congress, 3d Session, concluded that further improvement of the Saco River above Saco-Biddeford, Maine, for navigation in combination with power development, the control of floods, or the needs of irrigation was not economically justified at the time.

b. NENYIAC Report. Flood control and allied water uses in the Saco River Basin are considered in Part 2, Chapter IX of the report "The Resources of the New England-New York Region," a comprehensive survey of the land, water, and related resources of the New England-New York region. This report was prepared by the New England-New York Inter-Agency Committee and submitted to the President of the United States by the Secretary of the Army on April 27, 1956. Part I and Chapter I of Part 2 are printed as Senate Document 14, 85th Congress, 1st Session. No plan of improvement for the sole purpose

of reducing flood damages in the basin was presented in this report since the cost for such work was not economically justified at the time. However, a plan was proposed for power development consisting of two improvements, at Great Falls and Steep Falls.

4. DESCRIPTION

a. Topography. The Saco River basin covers an area of 1,697 square miles and extends about 75 miles from the Atlantic Ocean in southwestern Maine to the White Mountains in east central New Hampshire. Rising in a high and rugged region of very steep valleys and river slopes, the headwaters are at a general elevation of about 1,900 feet, msl. Much of this portion of the basin lies within the White Mountain National Forest. The topography moderates in the central part of the basin where generally rolling hills predominate, wide valleys hold farms and small towns, and an occasional bedrock mountain rises to prominence. The lower portion of the basin comprises a sand and clay-filled area of low relief, having numerous sand dunes. Heavy forest covers most of the upper and coastal areas of the basin with stands of virgin timber in the north and regrowth on once-cleared land near the coast.

b. Main and Tributary Streams. The Saco River begins at the outlet of Saco Lake in Crawford Notch in the White Mountains, New Hampshire, and follows a sinuous course in a general southeasterly direction for about 124 miles to its mouth five miles below the head of tidewater at Saco and Biddeford, Maine. In the 119 miles of its length above tidewater the river falls about 1,900 feet. Nearly 1,240 feet of this fall occurs in the upper 14 miles, about 295 feet in the next 37 miles, about 19 feet in the next 19 miles, through several ponds and swamps, and then 346 feet in the lower 49 miles.

The principal tributaries of the Saco River are the Swift River, that joins the main stream at Conway, New Hampshire; the Ossipee River, that flows into the Saco River at Cornish, Maine; and the Little Ossipee River, that empties into the Saco River at East Limington, Maine.

5. PROBLEMS INVESTIGATED

a. History of Flooding. Due to steep slopes and a relative lack of valley storage in the upper mountainous portion of the basin, quick runoff of storm rainfall poses the threat of rapid concentration of flood

flows on the main stem of the Saco. Major floods have occurred in the spring of the year as a result of heavy rainfall combined with snowmelt. Five great floods have been recorded in the Saco River in the past 45 years; in May 1923, April 1933, March 1936, May 1940, and March 1953. The March 1936 flood is the greatest known in the lower reaches of the river and the March 1953 flood the greatest of record in the upper portion of the basin. Basin losses of $1.6 million and $1.8 million, respectively, were experienced in the 1936 and 1953 floods.

b. Problem Areas. Studies for this report reviewed flood problem areas in the watershed from the headwaters to and including Saco and Biddeford near the mouth of the river. Some 20 communities are located in the flood zones of the main Saco River. Chief damage centers in the lower basin are at the cities of Saco and Biddeford, Maine.

In the flood of March 1936, some 2000 people were rendered temporarily homeless and about 100 acres of the Saco-Biddeford area were inundated with flood waters up to 10 feet deep, affecting more than 500 buildings. Ninety-five percent of Saco River Basin flood damages in the 1936 flood occurred in Maine. In the 1953 flood, flooding of industrial plants in the Saco-Biddeford area forced suspension of operations for periods up to 10 days and caused residential areas of Saco to be evacuated and commercial interests to close down. This flood, the greatest of record in the upper basin, caused flood damages to about 100 summer homes on Ossipee Lake and flooded 90 buildings on Bearcamp River in New Hampshire.

Flood damage areas also exist on the feeder streams of Swift River, the Saco River above Glen, the Glen Ellis River, the East Branch of the Saco River in New Hampshire, and the Cold River in New Hampshire and Maine. Transportation over National Forest highways has been disrupted along the Swift River in Crawford and Pinkham Notches and along the Cold River. Other damages from floods were reported at North Conway, New Hampshire, and Hiram, Maine.

c. Desired Improvements. To obtain the views of local people, a public hearing was held in North Conway, New Hampshire, on 14 June 1962. Over 150 persons attended, including representatives of Federal, State, and municipal governments, industrial and agricultural interests, civic organizations, and interested individuals. Desires were expressed by individuals and agencies for some means of flood control in specific areas but no definite plan of improvement was

suggested. One individual reported that his property is threatened by creeping bank erosion and felt that steps should be taken to prevent further damage. A request was made by a representative of the State of New Hampshire for Federal assistance in the construction of the contemplated expansion of recreational and conservation facilities for Echo Lake State Park in North Conway, New Hampshire. A spokesman for the North Conway Water Precinct explained the town's need to develop additional sources of water supply.

6. SOLUTIONS CONSIDERED

a. Local Flood Protection.

A field survey of flood losses in the flood zones of the major streams of the basin indicated that two communities, Saco and Biddeford, Maine, have concentrations of flood damage. Those communities were considered for local protection. Preliminary studies of protection by means of earth dikes, concrete walls, and pumping stations at three separate areas in these communities - one in Saco and two in Biddeford - indicated that protection is not economically justified at this time for any of these areas.

Flood protection at Crystal Lake in Eaton, New Hampshire, was investigated. It was determined that local flood control measures were not justified in this area.

Bank erosion problems on the Saco River at Glen, New Hampshire, were also investigated. No economic means exist for the Federal government to stabilize or protect the river banks.

b. Dams and Reservoirs

(1) Flood control only. Exploration of the entire basin area for potential flood control dam and reservoir sites resulted in the selection of 26 possible sites, each of which was given due consideration. Twenty of these were studied in detail and their construction by the Federal government was found to be not justified.

(2) Multiple-purpose projects.

(a) General. Six of the twenty "flood control only" reservoirs together with nine additional reservoirs were selected for multiple-

purpose studies to include flood control, hydroelectric power, recreation, fish and wildlife enhancement, water supply, and low flow improvement. Plate No. 1 shows the locations of the sites studied.

(b) Flood control. In previous reports on the Saco River Basin, flood protection was considered at a number of areas but no economically justified projects were found. The current authorization for this report requires that determination be made of the advisability of adopting further measures for flood control and allied purposes. All reservoir projects studied for this report included flood control as a project purpose.

(c) Hydroelectric power. The Federal Power Commission reported that the New England power load could effectively utilize any peaking power available from Saco River projects. All multiple-purpose projects studied for this report consider hydroelectric peaking power as a project purpose. Power values for benefits and alternative costs were derived from Federal Power Commission estimates. The values which, in the early stages of the study were based on the costs of a conventional steam-electric plant, were revised downward upon determining the feasibility of pumped-storage hydroelectric plants for use with nuclear fueled thermal plants.

(d) General recreation. The New Hampshire Department of Resources and Economic Development, Division of Parks, which expressed an interest in water-based recreation, made a study of expansion of the existing Echo Lake State Park recreational facilities at North Conway, New Hampshire. A 1960 survey by the State of Maine indicated a need for additional public recreation areas. The multiple-purpose reservoirs studied for this report include general recreation as a project purpose.

(e) Fish and wildlife. The Fish and Wildlife Service, Bureau of Sport Fisheries and Wildlife, in cooperation with the New Hampshire Fish and Game Department and the Maine Department of Inland Fisheries and Game have made a preliminary study of the fish and wildlife resources of the Saco River basin as they are affected by project studies for this report. Specific recommendations made in regard to stream fishery, lake fishery, and waterfowl habitat were given full consideration in all the projects studied.

(f) Water supply and low flow improvement. Full consideration was given to the need for water supply and low flow improvement in the studies for multiple-purpose projects.

(g) Projects studied. Studies were made of multiple-purpose reservoirs at the following 15 sites:

Name	Stream	Drainage Area (sq. miles)
North Conway	Saco River	257
Conway	Saco River	386
West Fryeburg	Saco River	459
Fryeburg	Saco River	744
Bryant Pond	Saco River	799
Great Falls	Saco River	~~812~~ 832
Steep Falls	Saco River	1340
Charles River	Charles River	139
Ossipee Lake	Ossipee River	330
Kezar Falls	Ossipee River	417
Cornish	Ossipee River	442
Bearcamp River)		62
Pine River)	Tributaries of the	49
Spectacle Ponds)	Ossipee River	6
Ridlon Brook)		5

The basin map at the end of this report shows locations of the above sites.

7. DISCUSSION

The relatively narrow valley at the site of the Great Falls project in Hiram, Maine, and the large flood plain, extending upstream almost to the New Hampshire state line, act as an effective flood-retarding basin which has a marked reducing influence on all downstream flood discharges. It is estimated that about 200,000 acre-feet, equivalent to about 4.5 inches of runoff, were held in temporary storage in this area during the floods of March 1936 and March 1953. This storage afforded a considerable reduction and retardation of the flood crest moving downstream.

Most of the studied reservoirs included provisions for development of power and recreation as well as flood damage reduction. In addition to studies of single reservoirs, consideration was given to combinations

of reservoirs such as Great Falls with Steep Falls, Great Falls with West Fryeburg, Great Falls with North Conway, Bryant Pond with West Fryeburg, and Bryant Pond with North Conway. The reservoirs on the tributaries of the Ossipee River (the last four sites listed in the above table) were considered for purposes of flood control, recreation, and conservation storage acting in conjunction with both Great Falls and Kezar Falls in various combinations. In this complex, the usable flows from the reservoirs in the Ossipee River basin were diverted, for power purposes, into the Great Falls reservoir by way of a canal through the Tenmile River Valley. None of the projects studied would be justified for construction at the present time.

8. RESULTS OF THE INVESTIGATION

Structural solutions to flood problems in the basin by means of storage reservoirs and local protection methods were considered. Wherever possible, reservoir projects included allied purposes such as hydroelectric power, recreation, and conservation storage. None of the projects were considered to be economically justified at this time.

9. CONCLUSIONS

The Division Engineer concludes that no structural improvements for flood control and allied purposes are warranted at this time. He considers that a flood plain management program should be established by local interests to reduce future flood losses.

10. RECOMMENDATIONS

The Division Engineer recommends no improvement of the Saco River Basin in the interests of flood control and allied purposes be undertaken by the Federal government at this time. He recommends, for the reduction of future flood damages, that local interests (1) regulate future development in flood hazard areas and (2) adopt suitable building codes providing for the flood-proofing of existing structures on the flood plain.

REMI O. RENIER
Colonel, Corps of Engineers
Acting Division Engineer

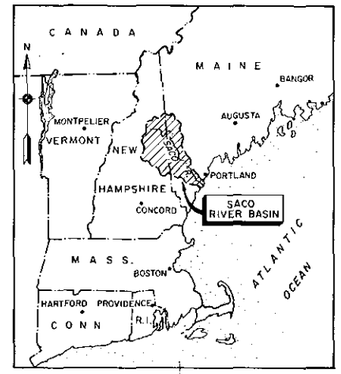
Incl.
Plate No. 1

CORPS OF ENGINEERS

U. S. ARMY

INDEX TO RESERVOIR SITES STUDIED

NO.	NAME	STREAM	KIND OF STUDY MADE	
			SINGLE PURPOSE FLOOD CONTROL	MULTIPLE PURPOSE
1	BARTLETT	SACO RIVER	X	
2	ELLIS RIVER	ELLIS RIVER	X	
3	EAST BRANCH SACO RIVER	EAST BRANCH SACO RIVER	X	
4	NORTH CONWAY	SACO RIVER	X	X
5	PASSACONWAY	SWIFT RIVER	X	
6	CONWAY	SACO RIVER	X	X
7	CONWAY LAKE	LAKE OUTLET	X	
8	WEST FRYEBURG	SACO RIVER		X
9	CHARLES RIVER	OLD COURSE SACO RIVER		X
10	BROWNFIELD	SHEPARDS RIVER	X	
11	FRYEBURG	SACO RIVER	X	X
12	MOOSE POND	MOOSE POND BROOK	X	
13	BRYANT POND	SACO RIVER		X
14	GREAT FALLS	SACO RIVER		X
15	BEARCAMP RIVER	BEARCAMP RIVER	X	X
16	SWIFT RIVER	SWIFT RIVER	X	
17	LOVELL RIVER	LOVELL RIVER	X	
18	BEECH RIVER	BEECH RIVER	X	
19	PINE RIVER NO. 2	PINE RIVER	X	
20	PINE RIVER NO. 1	PINE RIVER	X	X
21	OSSIPEE LAKE	OSSIPEE RIVER	X	X
22	KEZAR FALLS	OSSIPEE RIVER		X
23	SPECTACLE PONDS	PONDS OUTLET		X
24	RIDLON BROOK	RIDLON BROOK		X
25	CORNISH	OSSIPEE RIVER		X
26	STEEP FALLS	SACO RIVER		X
27	NEWFIELD	LITTLE OSSIPEE RIVER	X	
28	COOKS BROOK	COOKS BROOK	X	
29	DEEP BROOK	DEEP BROOK	X	



LOCATION MAP

SCALE IN MILES

25 0 25 50

LEGEND

① Reservoir Sites Studied

✕ SACO Local Protection Projects Studied

REVISION	DATE	DESCRIPTION	BY

U.S. ARMY ENGINEER DIVISION, NEW ENGLAND
CORPS OF ENGINEERS
WALTHAM, MASS.

DR. BY	TR. BY	CH. BY
L.R.M.	M.W.B.	D.C.

ENGINEER

PROJECT ENGINEER

CHIEF, PLANNING BRANCH

APPROVED

CHIEF, ENGINEERING DIV.

SACO RIVER BASIN

BASIN MAP

SACO RIVER MAINE & N.H.

DATE SEPT. 1967

TO ACCOMPANY REPORT
DATED: 15 SEPTEMBER 1967

SCALE AS SHOWN

DRAWING NUMBER

SHEET 1 OF 1

PLATE NO. 1